

LONDON- WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA14 | Newton Purcell to Brackley

Data appendix (AG-001-014)

Agriculture, forestry and soils

November 2013

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Department
for Transport

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1 Introduction

1.1.1 The agriculture, forestry and soils appendix for the Newton Purcell to Brackley community forum area (CFA14) comprises:

- soils and Agricultural Land Classification (ALC) surveys (Section 2);
- forestry (Section 3); and
- farm impact assessment summaries (Section 4).

1.1.2 Maps referred to throughout the agriculture, forestry and soils appendix are contained in the Volume 5, Agriculture, Forestry and Soils Map Book.

2 Soils and Agricultural Land Classification surveys

2.1 Background

- 2.1.1 The agricultural baseline data has been derived from both desk study and site investigation. Information gathered by the desk study has related primarily to the identification of soil resources in the study area, the associated physical characteristics of geology, topography and climate which underpin the assessment of agricultural land quality, and the disposition of land uses. The main sources of information have included:
- National Soil Map¹;
 - Soils and Their Use in South East England²;
 - solid and superficial deposits from the Geology of Britain viewer³;
 - gridpoint meteorological data for agricultural land classification of England and Wales⁴;
 - Provisional Agricultural Land Classification of England and Wales (1:250,000)⁵;
 - Likelihood of Best and Most Versatile Agricultural Land (1:250,000)⁶;
 - agri-environment schemes⁷;
 - computer-aided light detection and ranging (LiDAR) elevation data for determination of gradient; and
 - aerial photography.
- 2.1.2 Where the collection of agricultural site information has enabled a review/refinement of published information, this was undertaken in accordance with the methodology prescribed by the Ministry of Agriculture, Fisheries and Food (MAFF)⁸.
- 2.1.3 Engagement with landowners and tenants between May 2012 and June 2013 has established the nature and extent of agricultural, forestry and related rural enterprises. Information obtained from farm impact assessment interview surveys has been taken as a factual representation of local agricultural and forestry interests and has not been subject to further evaluation.

¹ Cranfield University (2001), *The National Soil Map of England and Wales* 1:250,000 scale.

² Soil Survey of England and Wales (1984), *Soils and Their Use in South East England*.

³ British Geological Survey. <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>: Accessed on 18 March 2013

⁴ Meteorological Office (1989), *Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations*.

⁵ Ministry of Agriculture, Fisheries and Food (MAFF), (1983), *Agricultural Land Classification of England and Wales* (1:250,000).

⁶ Department for Environment, Food and Rural Affairs (Defra) (2005), *Likelihood of Best and Most Versatile Agricultural Land* (1:250,000).

⁷ Multi-Agency Geographical Information for the Countryside (MAGIC) available on line @ www.magic.gov.uk, accessed August 2013.

⁸ MAFF, (1988), *Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land*.

2.2 Soils and land resources

- 2.2.1 The location and extent of soil types displaying different characteristics and of agricultural land in the different ALC grades are influenced by topography, drainage, geology and soil parent material, which are described in turn below. This section then provides a description and distribution of the main soil types encountered along the study corridor.

Topography and drainage

- 2.2.2 The predominantly rural landscape forms part of the broad valley of the River Great Ouse in the south, whilst to the north the landform is broadly domed and gently undulating. The main landform features are the floodplain of the River Great Ouse and its tributaries. The altitude in this area ranges from around 90m to 125m above Ordnance Datum (AOD).

Geology and soil parent materials

- 2.2.3 The principal underlying geology mapped by the British Geological Survey comprises various limestone and mudstone units of the Great Oolite group, including the White Limestone, Cornbrash, Whitby Mudstone, Forest Marble and Blisworth Limestone Formations. Large areas of superficial glaciofluvial deposits of sand and gravel are mapped to the south of the study area.
- 2.2.4 The Whitby Mudstone Formation is mapped in conjunction with the course of the River Great Ouse, with superficial deposits of alluvium, comprising sand, silt, clay and gravel.
- 2.2.5 A list of geological strata occurring within the study area is provided in age order in Table 1 and shown on Map WR-02-014 (Volume 5, Water Resources Map Book).

Table 1: Bedrock and soil forming materials

Formation	Composition/soil parent material
Whitby Mudstone	Fossiliferous mudstone and siltstone with rare fine-grained calcareous sandstone beds
White Limestone	Pale grey to off-white or yellowish limestone, with variable grain and lime mud components
Forest Marble	Silicate-mudstone, variably calcareous and commonly sandy with cross bedded limestone units
Blisworth Limestone	Pale grey to off-white or yellowish limestone with thin marls and mudstones, fossiliferous
Superficial deposits	
River terrace	Sequences of sands and gravels with flint, quartz and quartzite
Alluvium	Compressible silty clay, (silt, sand and gravel)

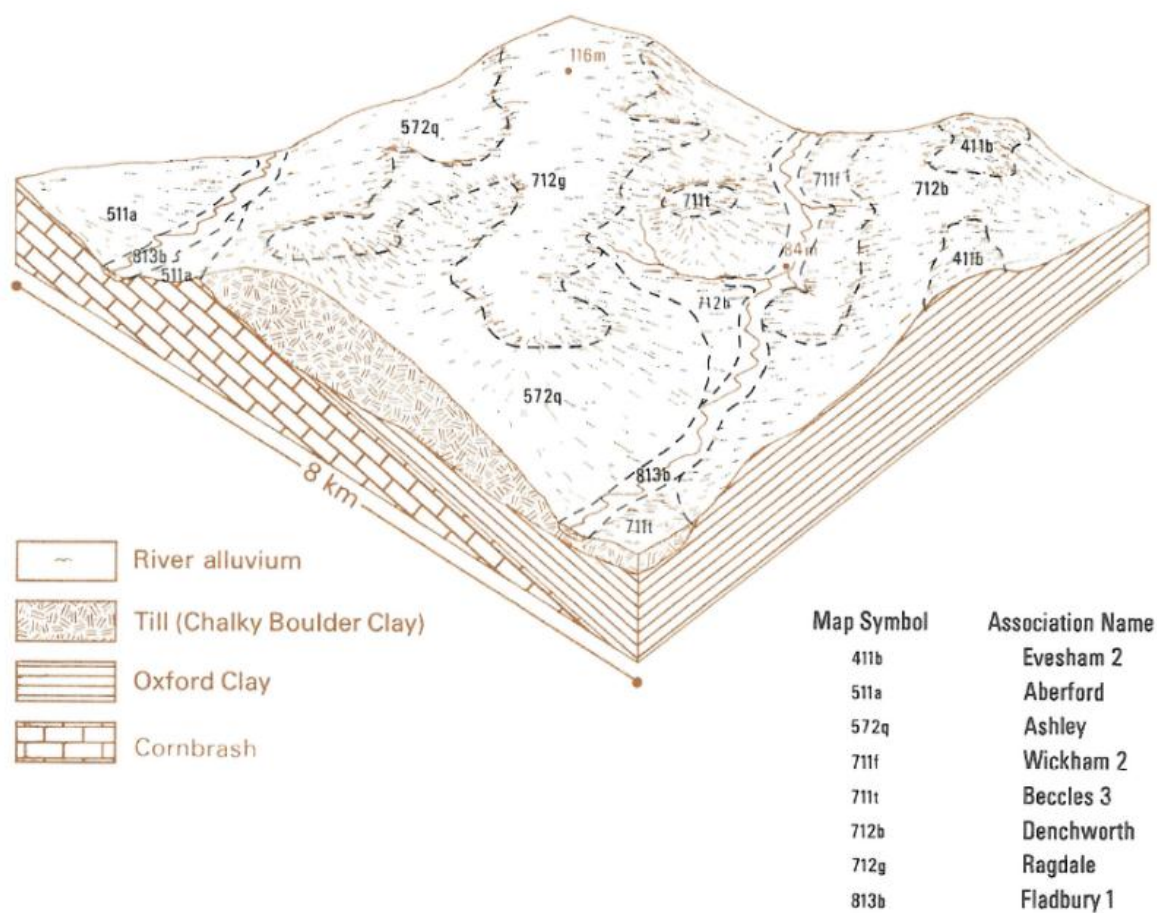
Description and distribution of soil types

- 2.2.6 The characteristics of the soils are described by the Soil Survey of England and Wales² and shown on the National Soil Map¹. The soils are grouped into associations of a range of soil series showing similar characteristics.
- 2.2.7 The National Soil Map shows four broad soil types across the section:
- in the south-east the soils are generally clayey and loamy soils which are slowly permeable or have impeded drainage and are mostly acidic;
 - in the south-east are pockets of slowly permeable, clayey and loamy soils which are base-rich;
 - around Westbury and Brackley the soils are freely draining, lime-rich and loamy and of variable depth; and,
 - to the north-west profiles become slowly permeable, loamy and clayey and seasonally wet.
- 2.2.8 Most of the study area has soil of the Aberford association which are characterised by well-drained, fine loamy soils overlying limestone. These soils are of Wetness Class I⁹ (WC I) and are typically calcareous.
- 2.2.9 In the centre and south soils of the Bishampton 2, Essendon, Ashley and Elmton 3 associations are mapped, which collectively consist of loamy or clayey topsoils over clayey subsoils. Moderately well-drained, fine loamy Bishampton 2 soils of WC II or III occur on the slopes of the section, while Essendon soils occur on the higher, flatter land in the area and are typically imperfectly to poorly drained of WC III or IV. Interbedded limestone and mudstone on the plateau to the east of Brackley gives rise to a reversal in this pattern, with the typically calcareous Ashley soils of WC II on the slopes up from the river channel and better draining, WC I, variably stony and shallow Elmton 3 soils on the flatter top.
- 2.2.10 In the south and north soils of the Ragdale association begin to show a presence where land is undulating and overlying Oolite Group limestone bedrock which is overlain with clayey alluvium.
- 2.2.11 The floodplain of the River Great Ouse supports the Fladbury 1 association which is wet, clayey and moderately to poorly drained (WC III or IV).
- 2.2.12 Some of these associations are depicted below in Figure 1 and Figure 2 which show where each soil develops in relation to geology and topography. Where profile descriptions are available, the predominant soil series of each association is described in detail in Table 2 (taken from the Soils Guide). Colour abbreviations are derived from a standard Munsell Soil Colour Chart¹⁰.

⁹ The Wetness Class of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six bands.

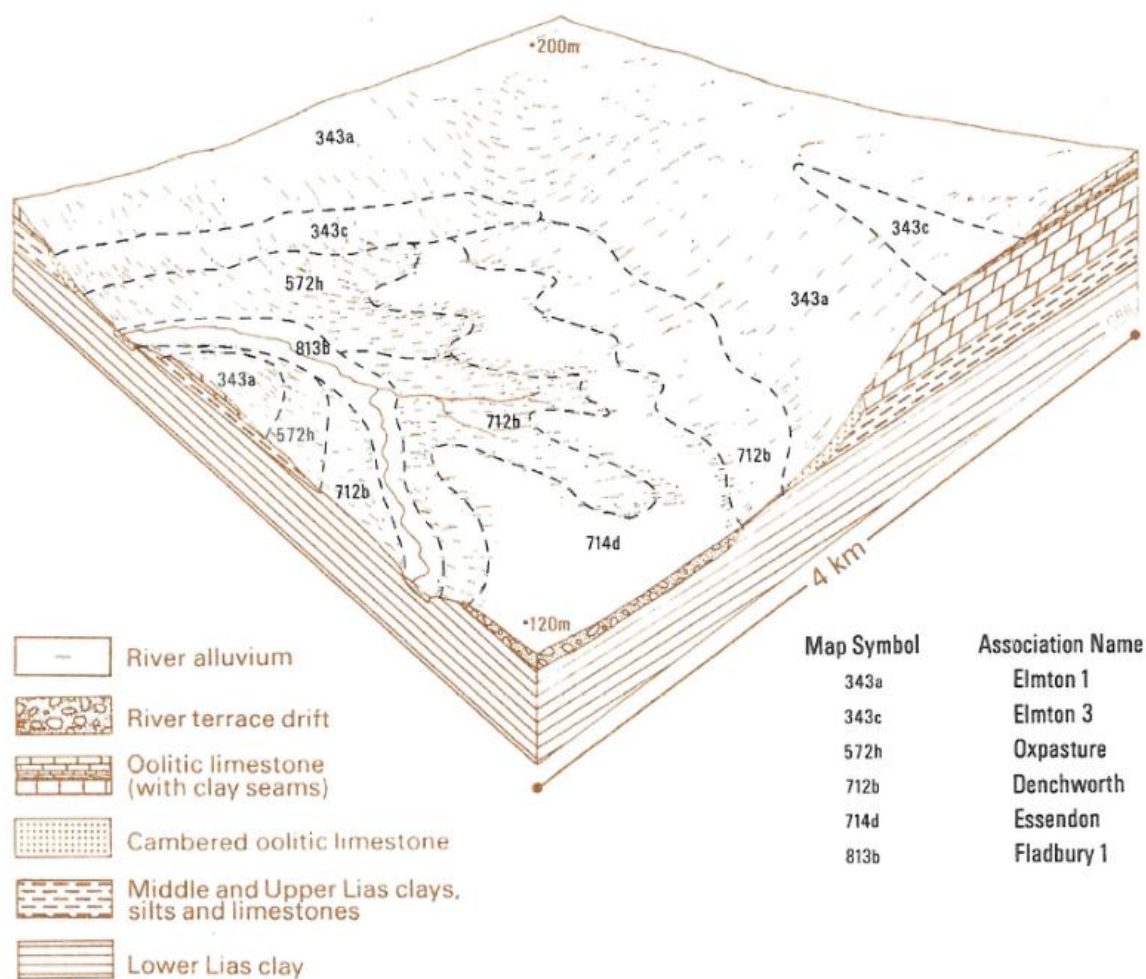
¹⁰ Munsell (2000), *Munsell Color Charts*, Munsell Color, Grand Rapids, MI, USA.

Figure 1: Aberford, Ashley, Ragdale and Fladbury soil associations in a landscape context ¹¹



¹¹ National Soil Resources Institute (NSRI) 2013. *The Soils Guide*. Available: <http://www.landis.org.uk/>, Cranfield University, UK

Figure 2: Elmtón 3, Essendon and Fladbury 1 soil associations in a landscape context ¹²



¹² National Soil Resources Institute (NSRI) 2013. *The Soils Guide*. Available: <http://www.landis.org.uk/>, Cranfield University, UK

Table 2: Dominant soil series

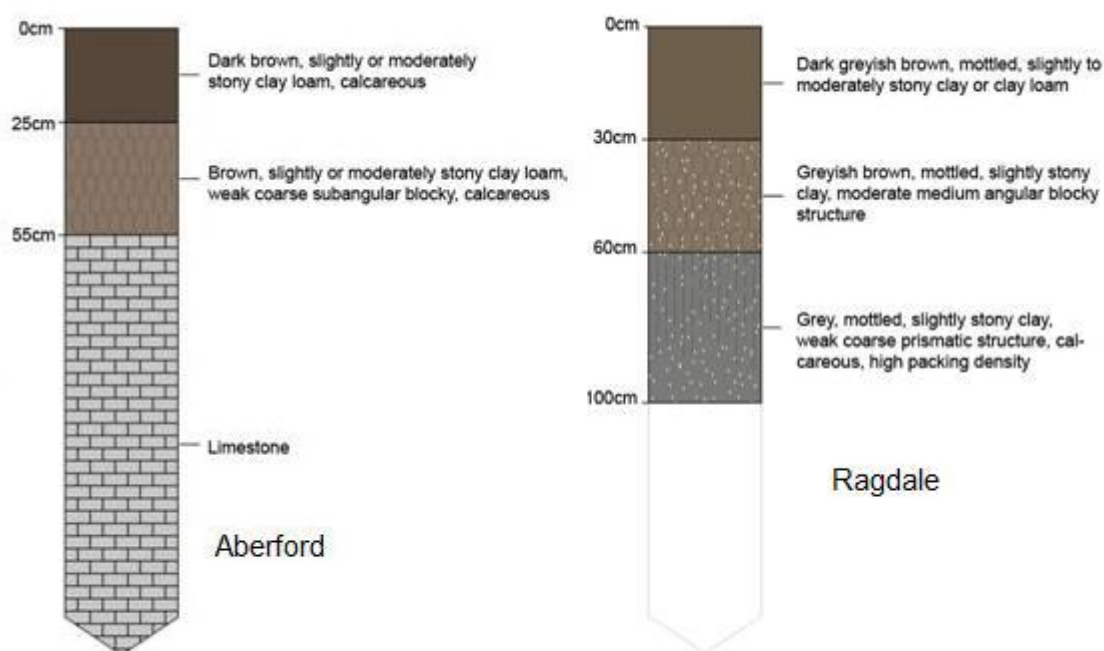
Bishampton series	Essendon series	Fladbury series
ocm-13cm, dark brown (7.5YR3/2) ¹³ stoneless humose sandy clay loam; moist; strongly developed fine subangular blocky; low packing density; moderately weak soil and ped strength; abundant very fine fibrous roots; non-calcareous; abrupt smooth boundary	ocm-8cm, black (7.5YR2/1) stoneless loamy peat; very moist; moderately developed coarse granular; low packing density; common medium woody roots and bracken rhizomes; non-calcareous; sharp smooth boundary	ocm-24cm, dark brown (10YR3/3) stoneless clay; moist; moderately developed medium angular blocky; low packing density; moderately weak soil strength; few very fine fibrous roots; non-calcareous; sharp smooth boundary
13cm-38cm, brown to dark brown (7.5YR4/3) very slightly stony sandy clay loam; small rounded quartzite; slightly moist; moderately developed medium subangular blocky; medium packing density; moderately firm soil strength; moderately weak ped strength; many very fine fibrous roots; non-calcareous; abrupt smooth boundary	8cm-25cm, light brownish grey (10YR6/2) moderately stony fine sandy silt loam with common medium brown to dark brown (7.5YR4/2) and yellowish brown (10YR5/6) mottles; medium rounded flint; very moist; weakly developed medium subangular blocky; low packing density; moderately firm soil strength; common medium woody roots; non-calcareous; clear smooth boundary	24cm-53cm, greyish brown (2.5Y5/2) stoneless clay with very many fine strong brown (7.5YR5/8) mottles; moderately developed coarse prismatic with greyish brown (10YR5/2) faces; medium packing density; moderately firm ped strength; few very fine fibrous roots; non-calcareous; few irregular soft ferri-manganiferous concentrations; abrupt smooth boundary
38cm-59cm, brown to dark brown (10YR4/3) slightly stony sandy clay loam; medium rounded quartzite and subrounded sandstone and flint; slightly moist; moderately developed medium subangular blocky; medium packing density; moderately firm soil strength; moderately weak ped strength; many fine fibrous roots; non-calcareous; abrupt smooth boundary	25cm-40cm, light brownish grey (2.5Y6/2) slightly stony clay loam with many medium strong brown (7.5YR5/8) mottles; medium rounded flint and quartz; wet; moderately developed coarse angular blocky; medium packing density; moderately firm soil strength; common medium woody roots; non-calcareous; clear wavy boundary	53cm-78cm, dark grey (10YR4/1) slightly stony clay with many medium yellowish brown (10YR5/6) mottles; very small subangular sandstone; very moist; moderately developed coarse prismatic with dark greyish brown (10YR4/2) faces; medium packing density; moderately firm soil strength; very few fine fibrous roots; non-calcareous; few rounded ferri-manganiferous nodules; clear smooth boundary
59cm-85cm, brown to dark brown (7.5YR4/3) slightly stony sandy clay loam with common extremely fine strong brown (7.5YR5/6) and yellowish brown (10YR5/4) mottles; medium rounded quartzite; moist; moderately developed medium angular blocky; medium packing density; moderately firm soil and ped strength; non-calcareous; common clay coats; abrupt smooth boundary	40cm-65cm, strong brown (7.5YR5/8) slightly stony clay with many medium grey (5Y5/1) and red (2.5YR5/8) mottles; medium rounded flint and few quartz; wet; strongly developed coarse angular blocky with grey (10YR5/1) faces; high packing density; moderately firm ped strength; common fine woody roots; non-calcareous; gradual smooth boundary	78cm-94cm, dark greyish brown (10YR4/2), stoneless clay loam with many medium reddish brown (5YR4/4) mottles; very moist; moderately developed medium prismatic with dark grey (10YR4/1) faces; medium packing density; moderately weak soil strength; common very fine fibrous roots; non-calcareous; common rounded soft ferruginous concentrations; abrupt wavy boundary
85cm-112cm, brown to dark brown (7.5YR4/4) moderately stony clay with very many coarse yellowish red (5YR4/6) mottles; medium rounded quartzite; moist; weakly developed medium prismatic with brown (7.5YR5/3) faces; high packing density; moderately firm soil and ped strength; few very fine fibrous roots; non-calcareous; common	65cm-95cm, strong brown (7.5YR5/8) slightly stony clay with many medium grey (5Y5/1) and common medium red (2.5YR4/8) mottles; medium rounded flint; wet; strongly developed coarse angular blocky with grey (5Y5/1) faces; high packing density; moderately firm ped strength; few medium woody roots;	94cm-120cm, light grey to grey (10YR6/1) stoneless clay with many fine strong brown (7.5YR5/6) mottles; wet; weakly developed; adherent medium angular blocky with greyish brown (10YR5/2) faces; medium packing density; moderately firm soil strength; few very fine fibrous roots; non-

¹³ Munsell colour notation describes colour by three attributes: hue with five principle colours - red (R), yellow (Y), green (G), blue (B), and purple (P) with a preceding intermediate value 2.5-10; value or brightness where zero is black (most dark) and ten is white (most light); and chroma that distinguishes the difference from a pure hue to a gray shade.

Bishampton series	Essendon series	Fladbury series
irregular soft ferri-manganiferous concentrations; many clay coats around stones and few filling pores	non-calcareous	calcareous

2.2.13 There are no detailed descriptions available for Aberford and Ragdale soils and typical profiles are depicted in Figure 3 alongside a basic description of each horizon.

Figure 3: Predominant soil series profile descriptions ¹⁴



2.3 Soil and land use interactions

Agricultural land quality

2.3.1 A review of background ALC information has been undertaken to ascertain the land quality context within the study area. Detailed post-1988 ALC data was available for two sites along the proposed route and further two sites on the western boundary of Brackley. One additional ALC survey was undertaken for the purpose of this assessment.

Detailed Agricultural Land Classification - Tibbetts Farm

2.3.2 The land at Tibbetts Farm (CFA14/5) was being used to grow arable crops at the time of survey.

¹⁴ National Soil Resources Institute (NSRI) 2013. The Soils Guide. Cranfield University, UK. Available: <http://www.landis.org.uk/>; Accessed August 2013

- 2.3.3 Soil profiles were examined using an Edelman (Dutch) auger and spade. Approximately one observation is made for each hectare or for every 100m linear run of the track in those surveys undertaken for the present assessment. At each observation point the following characteristics were assessed for each soil horizon up to a maximum of 120cm or any impenetrable layer:
- soil texture;
 - significant stoniness;
 - colour (including local gley and mottle colours);
 - consistency;
 - structural condition;
 - free carbonate; and
 - depth.
- 2.3.4 Soil wetness was inferred from the matrix colour, presence or absence of, and depth to, greyish and ochreous gley mottling and/or poorly permeable subsoil layers at least 15cm thick.
- 2.3.5 Soil droughtiness was investigated by the calculation of moisture balance equations. Crop-adjusted available water is estimated from texture, stoniness and depth, and then compared to a calculated moisture deficit for the standard crops wheat and potatoes. The moisture deficit is a function of potential evapotranspiration and rainfall.
- 2.3.6 Grading of the land can be affected if the crop-adjusted available water is insufficient to balance the moisture deficit and droughtiness occurs. When a profile is found with significant stoniness, sufficient to prevent penetration of a hand auger, then it is assumed, for the purposes of calculating droughtiness, that similar levels of stoniness continues to the full 1.2m depth considered. The methodology and calculation used to determine the severity of a droughtiness limitation is given in Figure 4.
- 2.3.7 Available existing ALC surveys to the north and west of Newton Purcell show land quality to be generally very good, with 80% of the land surveyed (totalling approximately 115ha) being Grade 2. There are smaller proportions of Subgrade 3a (18.5ha, making up approximately 13% of the area surveyed) and a smaller quantity again of Subgrade 3b quality (10ha approximately 7% of the area surveyed).
- 2.3.8 A detailed ALC survey undertaken at Mixbury found soil profiles to comprise clay loam topsoils overlying clay. Antecedent weather conditions had been hot and dry causing observations of soil profiles to be hindered at three locations in the mid-and northern-sections of the linear survey area in which it became impossible for the auger to penetrate subsoil. The profiles recorded therefore have a severe droughtiness limitation to Grade 4, although this is considered to be an inaccurate assessment. Extrapolating from neighbouring observations on comparable microtopography suggests the two central locations are most likely to be of Subgrade 3b, with the northern location of Grade 2.

- 2.3.9 The resultant proportions of land of different qualities are therefore approximately 60% Subgrade 3b, 10% Subgrade 3a and 30% Grade 2.

Desk assessment of Agricultural Land Classification

- 2.3.10 The study area has been subject to an intensive desk based assessment which has relied on the interpretation of soil mapping, topography and agro-climatic data and the interactions between each factor. This resulted in an assessment of the likely soil textures, soil drainage status, landform, gradient, presence of or depth to poorly permeable soil layers and the extent to which crop growth may be limited by soil droughtiness.
- 2.3.11 A professional judgement was then made as to the predominant ALC grade which is likely for a soil with the given characteristics found in the climatic zone of the location within CFA14. The judgement is influenced by the surveyor's experience of detailed surveys in the locality and on similar soil types. The resulting grade is that which is considered to be the most likely grade that would be found should a detailed site investigation be conducted, although this does not mean in all cases that that grade will be found in practice.
- 2.3.12 Context land quality was ascertained using information derived from the provisional ALC maps of England and Wales produced by the former MAFF in the 1960s and 1970s. These maps show the section to be provisionally mapped as predominantly Grade 3, with an intrusion of Grade 4 to the east of Brackley.
- 2.3.13 Provisional land quality mapping was produced on strategic scales of 1:63,360 and later 1:250,000. Furthermore, the provisional ALC was based on a methodology which has since been updated twice, including the sub-division of Grade 3 into Subgrades 3a and 3b, and therefore these maps cannot be used for the detailed assessment of individual sites.

Figure 4: Methodology for calculating the severity of a droughtiness limitation to Agricultural Land Classification grading¹⁵

$$AP \text{ wheat (mm)} = \frac{TA_{vt} \times LT_t + \sum (TA_{vs} \times LT_{50}) + \sum (EA_{vs} \times LT_{50-120})}{10}$$

where

TA_{vt} is Total available water (TA_v) for the topsoil texture

TA_{vs} is Total available water (TA_v) for each subsoil layer

EA_{vs} is Easily available water (EA_v) for each subsoil layer

LT_t is thickness (cm) of topsoil layer

LT_{50} is thickness (cm) of each subsoil layer to 50 cm depth

LT_{50-120} is thickness (cm) of each subsoil layer between 50 and 120 cm depth

Σ means 'sum of'.

$$AP \text{ potatoes (mm)} = \frac{TA_{vt} \times LT_t + \sum (TA_{vs} \times LT_{70})}{10}$$

where

LT_{70} is thickness (cm) of each subsoil layer to 70 cm depth

MB (Wheat) = AP (Wheat) - MD (Wheat)

MB (Potatoes) = AP (Potatoes) - MD (Potatoes)

Where

MB is the Moisture Balance

AP is the Crop-adjusted available water capacity

MD is the moisture deficit, as determined by the agro-climatic assessment.

Table 8 Grade according to droughtiness

Grade/ Subgrade	Moisture Balance limits (mm)		
	<i>wheat</i>		<i>potatoes</i>
1	+30	and	+10
2	+5	and	-10
3a	-20	and	-30
3b	-50	and	-55
4	<-50	or	<-55

¹⁵ Derived from: MAFF, (1988), *Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land*.

Agro-climatic data

- 2.3.14 The influence of climate on soil wetness is assessed by reference to median Field Capacity Days (FCD) when the soil moisture deficit is zero, to soil wetness class and to topsoil texture. Droughtiness is determined by comparing the available water capacity of the soil adjusted for the crop, with the moisture deficit for the locality for wheat and potatoes.
- 2.3.15 The local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point data set for four points within the CFA and which are set out in Table 3. The data show average temperatures to be moderately cool, with an average of 1,361 day°C. Rainfall in the section is around 675mm per year and is moderate. The average number of FCD in the Newton Purcell to Brackley area is 150 which is average for lowland England and is considered to be favourable for providing opportunities for agricultural land working
- 2.3.16 Fundamentally, climate in this study area does not in itself place any limitation upon land quality but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of the land.

Table 3: Local agro-climatic data

Agro-climatic parameter	Newton Purcell	Mixbury	Turweston	Radstone
Altitude (AOD)	110m	120m	120m	150m
Average annual rainfall	671mm	670mm	680mm	681mm
Accumulated temperature more than 0°C	1 386 day°	1,379 day°	1,343 day°	1,337 day°
Field capacity days	144 days	146 days	154 days	156 days
Average moisture deficit, wheat	102mm	101mm	99mm	99mm
Average moisture deficit, potatoes	92mm	91mm	88mm	87mm

Site limitations

- 2.3.17 The assessment of site factors is primarily concerned with the way in which topography influences the use of agricultural machinery and hence the cropping potential of land. Gradient and microrelief, with complex changes of slope angle or direction over short distances, are not considered likely to be a limiting factor to the ALC grading within the Newton Purcell to Brackley study area.
- 2.3.18 Flooding is limited to the floodplains of the River Great Ouse and its tributaries, which flow throughout the section; it is a potential limitation but its incidence is difficult to ascertain. Flood risk is determined by the extent, duration, frequency and timing of flooding events.

Soil limitations

- 2.3.19 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. Together they influence the functions of soil and affect the water availability for crops, drainage, workability and trafficability.
- 2.3.20 There are four broad soil characteristics (described previously) within the area which vary according to the geological units and deposits over which the soil developed. Generally, the textures are fine loamy and clayey, but variability is seen in drainage status, carbonate content and stoniness.

Interactive limitations

- 2.3.21 The physical limitations which result from interactions between climate, site and soil are soil wetness, droughtiness and susceptibility to erosion. Each soil can be allocated a WC based on soil structure, evidence of waterlogging and the number of FCD; the topsoil texture then determines its ALC Grade according to Table 6 of the MAFF ALC guidelines (Figure 5).
- 2.3.22 Under the climatic conditions applicable to this section and applying the methodology for calculating a soil droughtiness limitation (see Figure 4) to the typical Elmton 3 and Aberford soil profile it has been calculated that the profiles are likely to be of Subgrade 3a or Subgrade 3b limited by soil droughtiness.
- 2.3.23 Fine loamy Ashley and Bishampton 2 soils of WC II or III will be limited by soil wetness, but the severity depends upon the specific topsoil texture encountered. For example, if of WC II and a silt loam, medium silty clay loam, or medium clay loam texture, the soils will be of Grade 2. If of WC II and of heavy silty clay loam or heavy clay loam, the soils will be of Subgrade 3a. The same applies if soils are of the lower WC, WC III, albeit the grades will also be one lower: Subgrade 3a or Subgrade 3b (see Figure 5).
- 2.3.24 The detailed soil survey undertaken at Tibbetts Farm revealed soil profiles consistent with the description of the Aberford association and comprise moderately stony clay loam topsoils overlying clay subsoils. Occasional profiles had a greater sand component and included sandy clay or sandy loam subsoil textures. Most of the profiles examined had restricted depth and resulted in a droughtiness limitation across much of the area to Subgrade 3a, though occasional deeper profiles were observed which led to reduced severity of the droughtiness limitation to Grade 2.
- 2.3.25 Wetter loamy and clayey soils of the Fladbury 1 and Ragdale associations are limited by soil wetness to Subgrade 3a or 3b, as above, if of WC III, but if of WC IV, a limitation to Subgrade 3b will apply. Essendon soils of WC III with sandy loam topsoil are limited to Grade 2.

Figure 5: Agricultural Land Classification grade according to soil wetness¹⁶

Wetness Class	Texture ¹ of the top 25 cm	Field Capacity Days				
		<126	126-150	151-175	176-225	>225
I	S ² LS ³ SL SZL	1	1	1	1	2
	ZL MZCL MCL SCL	1	1	1	2	3a
	HZCL HCL	2	2	2	3a	3b
	SC ZC C	3a(2)	3a(2)	3a	3b	3b
II	S ² LS ³ SL SZL	1	1	1	2	3a
	ZL MZCL MCL SCL	2	2	2	3a	3b
	HZCL HCL	3a(2)	3a(2)	3a	3a	3b
	SC ZC C	3a(2)	3b(3a)	3b	3b	3b
III	S ² LS SL SZL	2	2	2	3a	3b
	ZL MZCL MCL SCL	3a(2)	3a(2)	3a	3a	3b
	HZCL HCL	3b(3a)	3b(3a)	3b	3b	4
	SC ZC C	3b(3a)	3b(3a)	3b	4	4
IV	S ² LS SL SZL	3a	3a	3a	3b	3b
	ZL MZCL MCL SCL	3b	3b	3b	3b	3b
	HZCL HCL	3b	3b	3b	4	4
	SC ZC C	3b	3b	3b	4	5
V	S LS SL SZL	4	4	4	4	4
	ZL MZCL MCL SCL	4	4	4	4	4
	HZCL HCL	4	4	4	4	4
	SC ZC C	4	4	4	5	5
Soils in Wetness Class VI - Grade 5						

¹ For naturally calcareous soils with more than 1% CaCO₃ and between 18% and 50% clay in the top 25 cm. the grade, where different from that of other soils, is shown in brackets

² Sand is not eligible for Grades 1, 2 or 3a

³ Loamy sand is not eligible for Grade 1

Where S = sand, Z = silt, C = clay, L = loamy and P = peat.

For sand the coarseness of the grain is sub-divided into coarse (c), medium (m) and fine (f). The subdivisions of clay loam and silty clay loam classes are indicated as medium (M) (less than 27% clay); heavy (H) (27-35% clay).

The average number of FCD in the Newton Purcell to Brackley area is 150, and shown in the highlighted column

¹⁶ Derived from: MAFF, (1988), *Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land*.

3 Forestry

- 3.1.1 Assessment of forestry resources has primarily had regard to the National Forest Inventory¹⁷. The area of land under forestry (i.e. trees and woodland) within 2km either side of the route centre line has been derived using Geographic Information System (GIS), and is shown in Table 4.
- 3.1.2 There are forestry resources to the south-west of the area including Spilsmere Wood, Shelswell Plantation, Mixbury Plantation and Diggings Wood, whilst to the south-east of Brackley is the South Ground Covert Local Wildlife Site. To the east of Brackley and around Radstone further pockets of woodland are interspersed.

Table 4: Area of woodland within the study area and construction boundary

	Area of forestry land (ha)	Percentage of forestry land (%)
Forestry land in 4km-wide study area	285	7% (forestry as a land use within 4km-wide study area)
Forestry land within construction boundary	11.2	Approximately 6% of the land required for the construction of the Proposed Scheme is presently wooded

¹⁷ Forestry Commission (2001), *National Forest Inventory Woodland and Ancient Woodland* (as updated).

4 Assessment of effects on holdings

- 4.1.1 The effects on holdings have been assessed through a series of interviews with farmers along the proposed route carried out between May 2012 and June 2013, as well as measurements of the applicable area of land required, according to the methodology set out in the Scope and Methodology Report (SMR) (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5, Appendix CT-001-000/2).
- 4.1.2 The nature of impacts considered comprises the temporary and permanent land required from the holding, the temporary and permanent severance of land, the permanent loss of key farm infrastructure and the imposition of disruptive effects (particularly noise and dust) on land uses and the holding's operations. These impacts occur primarily during the construction phase of the Proposed Scheme and are set out in Table 5.

Table 5: Summary of assessment of effect on holdings

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
CFA14/1 Manor Farm 38.1ha arable Medium sensitivity to change	Land required: 3.6ha (9%). Low impact Severance: none. Negligible impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft Code of Construction Practice ¹⁸ (CoCP). Negligible impact	Land required: 0.5ha (1%). Negligible impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: minor effect	Overall permanent assessment: negligible
CFA14/2 * Shelswell Estate 239.1ha arable Medium sensitivity to change	Land required: 22.6ha (9%). Low impact Severance: none. Negligible impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 17.9ha (7%). Low impact Severance: none. Negligible impact Infrastructure: farm building demolished. High impact
	Overall temporary assessment: minor effect	Overall permanent assessment: major/moderate effect due to agricultural building demolition
CFA14/3 Warren Farm 11.6ha equestrian grazing	Land required: 2.5ha (21%). High impact Severance: holding nominally severed by new access but aligned along field boundary. Low impact	Land required: 1.6ha (13%). Medium impact Severance: holding nominally severed by new access but aligned along field boundary. Low impact

¹⁸ (Volume 5: Appendix CT-003-000)

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
Medium sensitivity to change	Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Infrastructure: No buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: major/moderate due to proportion of holding removed	Overall permanent assessment: moderate effect due to proportion of holding removed
CFA14/4* Oaks Farm 5.3ha grazing Low sensitivity to change	Land required: 1.1ha (21%). High impact Severance: none. Negligible impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 0.7ha (13%). Medium impact Severance: none. Negligible impact Infrastructure: farm buildings demolished. High impact
	Overall temporary assessment: moderate effect due to the proportion of holding removed	Overall permanent assessment: moderate effect due to property demolition and proportion of holding removed
CFA14/5 Tibbetts Farm 404.7ha arable Medium sensitivity to change	Land required: 42ha (10%). Medium impact Severance: holding severed but accommodation structures and/or access under viaduct provided. Low impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 18.9ha (5%). Low impact Severance: holding severed but accommodation structures and/or access under viaduct provided. Low impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to the proportion of holding removed	Overall permanent assessment: minor effect
CFA14/6 Westbury Mill Farm 404.7ha arable Medium sensitivity to change	Land required: 44.3ha (11%). Medium impact Severance: holding severed but accommodation structures and/or access under viaduct provided. Low impact. Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 28.8ha (7%). Low impact Severance: holding severed but accommodation structures and/or access under viaduct provided. Low impact. Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to the proportion	Overall permanent assessment: minor effect

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
	of holding removed	
CFA14/7 Grovehill Farm 1 8ha equestrian grazing Low sensitivity to change	Land required: 0.8ha (10%). Medium impact Severance: none. Negligible impact Disruptive effects: construction noise and dust controlled via the draft CoCP. Negligible impact	Land required: 0.8ha (10%). Medium impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: minor effect	Overall permanent assessment: minor effect
CFA14/8 Grovehill Farm 2 48.1ha arable Medium sensitivity to change	Land required: 5.5ha (11%). Medium impact Severance: none. Negligible impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 4.2ha (9%). Low impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and medium sensitivity of holding	Overall permanent assessment: minor effect
CFA14/9 Oatleys Farm 133ha arable Medium sensitivity to change	Land required: 18.8ha (14%). Medium impact Severance: small parcel severed west of the Proposed Scheme accessed from highway, downgraded due to size (0.6ha). Low impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 4.3ha (3%). Negligible impact Severance: small parcel severed west of the Proposed Scheme accessed from highway, downgraded due to size (0.6ha). Low impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed	Overall permanent assessment: minor effect
CFA14/10 Glebe Farm 526.1ha arable, beef, sheep Medium sensitivity to change	Land required: 11.9ha (2%). Negligible impact Severance: 2.0ha severed to the east of the Proposed Scheme but no access provided; also during utility diversion. High impact downgraded due to size of parcel to low Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft	Land required: 6.6ha (1%). Negligible impact Severance: 2.0ha severed to the east of the Proposed Scheme but no access provided. High impact downgraded due to size of parcel to low Infrastructure: no buildings or other farm infrastructure affected. Negligible impact

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
	CoCP. Negligible impact	
	Overall temporary assessment: minor effect	Overall permanent assessment: minor effect
CFA14/11 * Oatleys Hall 15.6ha equestrian grazing Low sensitivity to change	Land required: 5.6ha (36%). High impact Severance: none. Negligible impact. Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 2.1ha (14%). Medium impact Severance: none. Negligible impact. Infrastructure: loss of polo pitch. High impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and low sensitivity	Overall permanent assessment: moderate effect due to loss of polo pitch and proportion of holding removed (low sensitivity)
CFA14/12 Turweston Glebe 8.6ha beef and sheep Low sensitivity to change	Land required: 2.4ha (28%). High impact Severance: none. Negligible impact. Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 1.3ha (15%). Medium impact Severance: none. Negligible impact. Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and low sensitivity	Overall permanent assessment: minor effect
CFA14/13* Ballabeg 9ha equestrian High sensitivity to change	Land required: 2.9ha (32%). High impact Severance: none. Negligible impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities but the holding is removed due to demolition during the construction phase. Negligible impact	Land required: 2.0ha (23%). High impact Severance: none. Negligible impact Infrastructure: residential and equestrian buildings demolished. High impact
	Overall temporary assessment: major effect due to proportion of holding removed and high sensitivity	Overall permanent assessment: major effect due to residential property demolition and proportion of holding removed
CFA14/14 Laing 110.2ha arable	Land required: 17.1ha (15%). Medium impact Severance: none. Negligible impact. Disruptive effects: no impact on agricultural activity: construction dust	Land required: 9.8ha (9%). Low impact Severance: 2.0ha severed to the west of the Proposed Scheme with no access provided. High impact downgraded to Medium due to size of

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
Medium sensitivity to change	and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	parcel Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to the proportion of the holding removed	Overall permanent assessment: moderate effect due to the proportion of the holding removed and severance
CFA14/15 Versions Farm 52.5ha beef and sheep Medium sensitivity to change	Land required: 9.1ha (17%). Medium impact Severance: holding severed during construction of the Westbury viaduct but access ought to be maintained (as described in the draft CoCP) such that there should be no effective severance impact. Low impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 3.6ha (7%). Low impact Severance: although the holding is severed access fully available under Turweston viaduct. Low impact. Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed.	Overall permanent assessment: minor effect.
CFA14/16 * Manor Farm (Whitfield) 97.9ha arable and grazing Medium sensitivity to change	Land required: 20.5ha (21%). High impact Severance: 8.0ha severed to the south-west of the Proposed Scheme accessed from highway. Medium impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 10.5ha (11%). Medium impact Severance: 8.0ha severed to the south-west of the Proposed Scheme accessed from highway. Medium impact Infrastructure: point-to-point course compromised with the loss of part of the track. High impact
	Overall temporary assessment: major/moderate effect due to proportion of holding removed and severance	Overall permanent assessment: major/moderate effect due to impact on point-to-point course, severance and proportion of holding removed
CFA14/17 Illetts Farm 83.8ha Dairy High sensitivity to change	Land required: 20.7ha (25%). High impact Severance: holding severed but access maintained with accommodation structure. Low impact. Disruptive effects: dairy buildings located 500m north of Proposed Scheme. No impact on agricultural activity: construction dust and noise controlled via the mitigation measures	Land required: 13.4ha (16%). Medium impact Severance: holding severed but access maintained with accommodation structure. Low impact. Infrastructure: secondary farmstead (residential and agricultural buildings) demolished. High impact

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
	set out within the draft CoCP. Negligible impact	
	Overall temporary assessment: major effect due to proportion of holding removed, severance and high sensitivity	Overall permanent assessment: major effect due to property demolition, severance and proportion of holding removed (high sensitivity)
CFA14/18 Radstone Manor 401.2ha arable Medium sensitivity to change	Land required: 92.5ha (23%). High impact Severance: holding severed but access maintained with accommodation structure. Low impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 42.5ha (11%). Medium impact Severance: holding severed but access maintained with accommodation structure. Low impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: major/moderate effect due to proportion of holding removed and severance	Overall permanent assessment: moderate effect due to proportion of holding removed and severance
CFA14/19 Land associated with The Old Rectory, Newton Purcell 7.7ha grazing Low sensitivity to change	Land required: 2.7ha (35%). High impact Severance: none. Negligible impact Disruptive effects: no impact on agricultural activity: construction dust and noise controlled via the mitigation measures set out within the draft CoCP. Negligible impact	Land required: 1.2ha (16%). Medium impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed	Overall permanent assessment: minor effect due to proportion of holding removed
CFA14/20 Unnamed paddock 1 2.1ha equestrian Low sensitivity to change	Land required: 2.1ha (100%). High impact Severance: no additional severance caused during construction. Negligible impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities but all the land is removed during the construction phase. Negligible impact	Land required: 0.7ha (31%). High impact Severance: none. Negligible impact Infrastructure: stables demolished. High impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and low sensitivity	Overall permanent assessment: moderate effect due to proportion of holding removed, property demolition and low sensitivity
CFA14/21	Land required: 1ha (100%). High	Land required: 0.6ha (60%). High

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
Unnamed paddock 2 1ha equestrian Low sensitivity to change	impact Severance: no additional severance caused during construction. Negligible impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities, all the land is removed during the construction phase. Negligible impact	impact Severance: none. Negligible impact Infrastructure: stables demolished. High impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and low sensitivity	Overall permanent assessment: moderate effect due to proportion of holding removed, property demolition and low sensitivity
CFA14/22 Grovehill Barn grassland 6ha equestrian grazing Low sensitivity to change	Land required: 0.2ha (3%). Negligible impact Severance: none. Negligible impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities but all the land is removed during the construction phase. Negligible impact	Land required: < 0.1ha (1%). Negligible impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: negligible effect	Overall permanent assessment: negligible effect
CFA14/23 Unnamed paddock 3 3.3ha grazing Low sensitivity to change	Land required: 1.5ha (46%). High impact Severance: none. Negligible impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities but all the land is removed during the construction phase. Negligible impact	Land required: 0.2ha (6%). Low impact Severance: none. Negligible impact Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed and low sensitivity	Overall permanent assessment: negligible effect
CFA14/24 Hall Farm, Radstone 8.2ha arable and grazing Low sensitivity to change	Land required: 5.2ha (64%). High impact Severance: 0.2ha severed to the east of the Proposed Scheme. High impact downgraded due to size of parcel to low Disruptive effects: although construction noise and dust could be an issue for equestrian activities but all the land is removed during the construction phase. Negligible impact	Land required: 1.4ha (17%). Medium impact Severance: 0.2ha severed to the east of the Proposed Scheme. High impact downgraded due to size of parcel to low Infrastructure: no buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment:	Overall permanent assessment: minor

Holding reference, name and description	Construction effects	Residual effects post restoration of land required temporarily
	moderate effect due to proportion of holding removed and low sensitivity	effect
CFA14/25 1 Radstone Cottage 2.5ha grazing Low sensitivity to change	Land required: 1.3ha (51%). High impact Severance: severed during construction with no access to severed area. High impact Disruptive effects: although construction noise and dust could be an issue for equestrian activities but all the land is removed during the construction phase. Negligible impact	Land required: 0.3ha (11%). Medium impact Severance: none. Negligible impact Infrastructure: No buildings or other farm infrastructure affected. Negligible impact
	Overall temporary assessment: moderate effect due to proportion of holding removed, severance and low sensitivity	Overall permanent assessment: minor effect

* No farm impact assessment interview, data estimated

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